



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 16 1987

Ethyl Corp M'
US EPA RECORDS CENTER REGION 5



498094

OFFICE OF
THE INSPECTOR GENERAL

MEMORANDUM

SUBJECT: Hotline Case No. 476

FROM: Anna M. Virbick *Anna M. Virbick*
Assistant Inspector General for
Management and Technical Assessment

TO: Robert J. Bowden, Chief
Emergency Response Section
Region 5

We recently received the attached letter from the Michigan Department of Natural Resources (MDNR) summarizing the work completed by Ethyl Corporation on their Ferndale, Michigan, property.

Since hotline case number 476 was initially referred to your office for action, we would appreciate your assistance in determining if the MDNR summary adequately addresses EPA's concerns regarding the complainant's allegations. Please inform us of the results of your review by May 15, 1987, so that we may update our records.

Should your staff need additional information, please have them contact Maurice Blais of my staff on FTS 475-8960.

Attachment



JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

Gordon E. Guyer, Director

SOUTHEAST MICHIGAN FIELD OFFICE
GROUNDWATER QUALITY DIVISION
505 W. Main Street
Northville, Michigan 48167

March 30, 1987

NATURAL RESOURCES COMMISSION

THOMAS J. ANDERSON
MARLENE J. FLUHARTY
STEPHEN V. MONSMA
O. STEWART MYERS
DAVID D. OLSON
RAYMOND POUPORE
HARRY H. WHITELEY

Ms. Anna Burbick
Asst. Inspector General for
Management & Technical Assessment
A-109
401 M Street, S.W.
Washington, D.C. 20460

Re: Ethyl Corporation - Ferndale
Oakland County, Michigan
Hotline Case # 476

Dear Ms. Burbick:

As per request by your office, this letter serves to summarize work recently completed by Ethyl Corporation on their Ferndale property. Ethyl performed the work to address questions, raised by the Michigan Department of Natural Resources, as to the site's potential to cause groundwater contamination/degradation.

1. Ethyl Corporation dug several backhoe pits, under observation by MDNR staff, in locations coinciding with areas identified during a December, 1985 magnetometer survey as anomalous. There was no evidence of buried metal in any of the pits. It appears that the anomalous values may have been due to the close proximity, and subsequent interference, caused by nearby fencing and overhead power lines.
2. Ethyl Corporation performed some soil gas testing in those areas of the property previously occupied by underground gasoline storage tanks. Soil gas was collected onto charcoal tubes which were sent to a laboratory for analysis. No volatile organic compounds were detected from any of the locations.

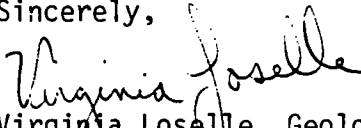
3. Ethyl Corporation installed four additional groundwater monitor wells around areas previously used for waste disposal. The existing, plus the new groundwater monitor wells, were sampled. Sample analyses indicated the presence of volatile organic compounds in the groundwater at several locations.

Because of the findings in Item #3 above, staff from the Michigan Department of Natural Resources met with representatives from Ethyl Corporation and recommended that they perform additional hydrogeologic work which would address the groundwater contamination issue. The Ethyl Corporation, Ferndale facility, has been, and still is included, on the Michigan Sites of Environmental Contamination, Act 307, list. The facility will remain on that list until either Ethyl Corporation performs the required hydrogeologic study, or Act 307 funds become available to complete the study.

I hope that this synopsis satisfactorily addresses your concerns regarding the Ethyl Corporation, Ferndale facility.

Should you have any further questions on this matter, please feel free to contact me at (313) 344-9440.

Sincerely,


Virginia Loselle, Geologist

Enclosure

cc: H. Shakir
S. Cunningham

ETHYL CORPORATION

CORPORATE ENVIRONMENTAL AFFAIRS

November 14, 1986

PLEASE ADDRESS REPLY
TO: 451 FLORIDA BLVD
BATON ROUGE, LA. 70801

Ms. Virginia Loselle
Michigan Department of Natural Resources
Groundwater Quality Division
15500 Sheldon Road
Northville, MI 48167

RECEIVED

NOV 17 1986

600-DETROIT DIST

Dear Ms. Loselle:

The environmental investigation of Ethyl's Ferndale Laboratory, as outlined in your letter of August 18, 1986, has been completed, and all requested data are enclosed.

As you observed on October 1, all of the high and erratic magnetometer readings in the nine-acre field across the north end of the property and the small open area just south of it were checked by digging with a backhoe. All of the ten holes were clean with no sign of chemical containers or contamination. Digging was more difficult than expected because most of the holes in the north plot uncovered foreign fill, clay, pieces of unreinforced concrete, and bricks, which had been used to level the field about 1953.

The absence of contamination was as expected because we had no information that anything had ever been buried in this area. The erratic magnetometer readings resulted from some electrical disturbance, either natural or from the nearby power lines.

Seven soils gas samples were taken in the three gasoline storage tank farm areas to determine if there was any contamination from prior tank leakage. An eighth sample was taken upgradient for use as a background sample. These were analyzed by gas chromatography by Burmah Technical Services whose report is attached. No contamination was found in any of them. This is consistent with the report by the Ferndale Fire Marshall, who monitored the removal of the tanks in 1985 and did not see any sign of contamination in any of the holes.

Four additional monitoring wells were drilled by Testing Engineers & Consultants, Inc. on October 8 and 9. The wells are all screwed four-inch PVC pipe construction with wrapped PVC screen as specified. The enclosed report includes the drilling logs and the results of the sieve analyses of the sand samples taken during the drilling of each well. These analyses describe a very uniform, fine sand. Average particle size was derived from the screen data and used in the definitive calculation of water flow through the sand versus slope of the water level. These calculations are attached.

The new wells and four of the old wells were sampled on October 10 and analyzed by Burmah Technical Services. All three of the new wells in the area north of the parking lot showed traces of organics which are evidently the result of disposals many years ago. The average concentration was 0.04 parts per million. This area measures 200 feet from west to east by 110 feet from north to south, and the water depth was 9.2 feet on October 10. The water levels in the three wells indicated the flow was directly east with a slope of 1.0 feet per 100 feet. By the attached calculation, the water flow was 0.678 gal./((day)(sq.ft.)). At this flow and concentration, the mass flow of organics leaving the area is only 0.083 pounds per year, or about one fluid ounce annually. The total amount of organics in the water under the area is about two fluid ounces.

The relatively high water slope makes us suspect that there is an interception point nearby. There are two parallel sewer lines between Ethyl's east fence and Pinecrest Avenue and the elevations permit infiltration into either of them. The newer one, which flows into the Twelve Town System, was designed to drain both sides of Pinecrest.

Some of the water is obviously being intercepted by the sewer system on the property. Even during dry weather, there is a constant flow in the sewers coming from both the north and west.

As we reported previously, Peter Shirey of the Geological Survey Division of the Michigan DNR searched their files and concluded that there were neither any wells nor aquifers near our property.

Well #8 was planned as an upgradient well, but the organics found here, only ten feet from the west fence line, may indicate that some of the contamination in the area could be from the area beyond AE Building. The flow directions and the water levels are consistent with this possibility.

In any case, there is very little organic material present in the water or leaving the property.

The highest concentration of organics was found in Well #7, the new well northeast of AE Building. This well contained less than 0.7 parts per million of chlorinated organics. The other wells in this area were clean except for traces of tetrahydrofuran, the pipe glue found previously.

The flow direction measured in this area has swung about twenty degrees more easterly since we measured it in April, 1986, when the water level was two feet higher. From the measured slope of 0.42 feet per 100 feet, we calculate the flow to be 0.285 gal/((day)(sq.ft.)).

The analysis from Well #7 is still indicative of a small amount of chemical. If we assume this analysis is typical of a 30-degree plume from the farthest pits, a plume 100 feet wide and 14 feet deep, the flow of hydrocarbons is only 0.8 pounds per year. We suspect that the plume is much smaller than this worst case scenario because the soil gas sample taken 125 feet downgradient from Well #7 was completely clean. This soil gas sample was a background check for the gasoline tank farm behind R Building, and it would have spotted any significant contamination in the water beneath it. The volatile and slightly soluble hydrocarbons evaporate preferentially from unconfined groundwater, but we would expect some remnant of the plume at this point unless it is many times smaller than assumed.

The data to date show that there are no removable containers or treatable concentrations of chemicals on the property. There appears to be a plume of minor contamination from known disposal points which were thoroughly dug into when the Laboratory was closed to be certain that there would be no future releases. The amount of contaminant under the property is quite small. If the four analyses represent a 30-degree plume stretching from the farthest disposal point all the way to the sewers beyond the east fence, we calculate only about twelve pounds of chemical is present .

As shown in the earlier calculations, the concentrations and amounts leaving the property are far too low to threaten either health or the environment, especially in the absence of any water wells in the area.

Very truly yours



C. E. Colvin

CEC:imc
Attachments

cc: S. Cunningham
D. C. Bach
D. E. Park

Water Flow Calculations

The rate of water flow through the fine sand under the Laboratory Property was calculated using the "Leva" correlation as described on pages 5-50 and 5-51 in the fourth edition of Perry's Chemical Engineers' Handbook.

This required successive calculations of the average sand particle diameter D_p , the modified Reynolds number N_{Re}' , the friction factor f_m , and finally the pressure drop or water slope.

For sand of mixed sizes, the average particle diameter can be calculated as

$$\frac{1}{D_p} = \sum \frac{x}{D_{p,x}}$$

where x = weight fractions of particle diameter $D_{p,x}$.

The four sieve analyses by Testing Engineers & Consultants, Inc. were averaged to give the following distribution of particle sizes:

	<u>wt. fraction, x</u>	<u>D_px</u>
larger than #4 screen	.00125	6.73 mm
between #4 and #8	.00300	3.37 mm
between #8 and #16	.00675	1.68 mm
between #16 and #30	.02975	.841 mm
between #30 and #50	.12450	.420 mm
between #50 and #100	.43200	.209 mm
between #100 and #200	.33575	.105 mm
smaller than #200 screen	.06700	.052 mm

From these data we calculated $D_p = 0.145$ mm or 0.000476 ft.

The modified Reynolds number is defined as:

$$N_{Re}' = \frac{D_p G}{\mu}$$

where G = water flow rate based on an empty chamber in lb./((hr.)(sq.ft.)) and μ = water viscosity in lb./((ft.)(hr.)).

Using the viscosity of water at 68°F 2.42 lb./((ft.)(hr.)) and the arbitrary value for G of .508 lb./((hr.)(sq.ft.)), we calculate $N_{Re}' = 10^{-4}$ (dimensionless).

The friction factor $f_m = 10^6$ (dimensionless) at this Reynolds number from Figure 5-64 in the text.

The pressure drop across the sand at this flow was then calculated with the Leva correlation,

$$\Delta P = \frac{2f_m G^2 L (1-\epsilon)^{3-n}}{D_p g_c \rho \phi^{3-n} \epsilon^3}$$

where ΔP = pressure drop in lbs./sq.ft.
 L = length of flow path, taken at 100 ft.
 ϵ = void fraction in the sand, 0.3
 n = exponent = 1 at $N_{Re}' < 10$
 g_c = dimensional constant, 32.17 ft./sec.²
 ρ = fluid density, 62.4 lb./ft.³
 ϕ = shape factor, average for sand .75
 $\Delta P_{100 \text{ ft.}} = 134.5 \text{ lb./ft.}^2$

This $\Delta P_{100 \text{ ft.}}$ may be converted to a slope by dividing by the density of water 62.4 lb/ft.³.

$$\text{slope} = 2.16 \text{ ft./100 ft.}$$

This involved calculation at a single flow rate, $G = .508$ lb./((hr.)(sq.ft.) or the more familiar $Q = 1.464$ gal./((day)(sq.ft.)), does not have to be repeated for other flow rates because flow is directly proportional to ΔP or slope in this laminar flow region and the generalized correlation below can be used

$$\begin{aligned} G(\text{lb})/(\text{hr})(\text{sq.ft.}) &= .235 \text{ slope (ft.)}/(100 \text{ ft.}) \\ Q(\text{gal})/(\text{day})(\text{sq.ft.}) &= .678 \text{ slope (ft.)}/(100 \text{ ft.}) \end{aligned}$$

From the well water levels taken on October 10, 1986, we calculate the following slopes and flows:

<u>Region</u>	<u>Slope</u> <u>ft./100 ft.</u>	<u>Q.(gal)/</u> <u>(day)(sq.ft.)</u>	<u>Rate, ft./year</u>
NW of AE Bldg.	.42	.285	46
N of Parking Lot	1.0	.678	110



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

October 22, 1986

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
Attn: C. E. Colvin III

Dear Mr. Colvin:

Please find enclosed, nine Volatile Organic Analysis reports.

The following paragraph qualifies incorporated test data for Analytical Laboratories Division's sample numbers: 13835-13843.

The data is from the analysis of charcoal adsorption tubes submitted by the client. Since the desorption efficiency from charcoal tubes is not known for all of the compounds normally detectable via Analytical Laboratories Division's VOA Scan procedure, the data must be reported assuming 100% desorption efficiency. The desorption efficiency for the key compounds of interest (aliphatic/aromatic hydrocarbons) is known to be quantitative and is not a concern in this instance.

If you have any questions, please don't hesitate to call me at 313 334-4747.

Sincerely,

A handwritten signature in cursive script, reading "Larry J. Frantz".

Larry J. Frantz, Technical Director

LJF/kd

Enclosures:



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13835

Client I.D.: Blank

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/1r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13836

Client I.D.: AL BLDG-SOUTH #1

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/2r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13837

Client I.D.: AL BLDG - NORTH #2

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/3r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13838

Client I.D.: B/C BLADES, SOUTH #3

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/4r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13839

Client I.D.: B/C BLDGS.-MIDLAND #4

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropane	<0.01		
trans-1,3-Dichloropropane	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/5r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86
Sample Number: 13840
Client I.D.: R BLOK-SCOTT #5

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/6r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86

Sample Number: 13841

Client I.D.: R BLDG - NORTH #6

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/7r



Burmah Technical Services, Inc.
Analytical Laboratories Division

408 Auburn Avenue
Pontiac, Michigan 48058

313-334-4747

Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86
Sample Number: 13842
Client I.D.: B/C BLDG.-NORTH #7

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/8r



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Analytical Laboratories Division

408 Auburn Avenue
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Ethyl Corporation
451 Florida Street
Baton Rouge, LA 70801
C.E. Colvin III

October 22, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-6-86
Sample Number: 13843
Client I.D.: Y BLOC-BACKGROUND

<u>Halogenated</u>	<u>ppm</u>	<u>Aromatic</u>	<u>ppm</u>
Bromodichloromethane	<0.02	Benzene	<0.01
Bromoform	<0.10	Ethyl Benzene	<0.01
Bromomethane	<0.05	Toluene	<0.01
Carbon tetrachloride	<0.01	Xylenes	<0.01
Chlorobenzene	<0.01	Styrene	<0.01
Chloroethane	<0.02		
2-Chloroethylvinyl ether	<0.05	<u>Others:</u>	
Chloroform	<0.01	Ketones	
Chloromethane	<0.05	Acetone	
Dibromochloromethane	<0.05	MEK	
1,2-Dichlorobenzene	<0.10	MIBK	
1,3-Dichlorobenzene	<0.10	Petroleum-	
1,4-Dichlorobenzene	<0.10	Distillates	
Dichlorodifluoromethane	<0.01		
1,1-Dichloroethane	<0.01		
1,2-Dichloroethane	<0.01		
1,1-Dichloroethene	<0.01		
trans-1,2-Dichloroethene	<0.01		
1,2-Dichloropropane	<0.01		
1,3-Dichloropropene	<0.01		
trans-1,3-Dichloropropene	<0.01		
Methylene Chloride	<0.01		
1,1,2,2-Tetrachloroethane	<0.01		
Tetrachloroethene	<0.01		
1,1,1-Trichloroethane	<0.01		
1,1,2-Trichloroethane	<0.01		
Trichloroethene	<0.01		
Trichlorofluoromethane	<0.01		
Vinyl Chloride	<0.05		

See attached letter

VOA/9r



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Ethyl Corporation
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Attn: C. E. Colvin III

October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14139

Client I.D.: WELL #1

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005	<u>Miscellaneous</u>	
Chloroform	<0.001	Tetrahydrofuran	0.195
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	<0.001		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

VOA/1r



Burmah Technical Services, Inc.
Analytical Laboratories Division

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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14140

Client I.D.: WELL #2

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.005	Ethyl Benzene	<0.001
Bromomethane	<0.010	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005	<u>Miscellaneous:</u>	
Chloroform	<0.001	Tetrahydrofuran	0.140
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	<0.001		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

Ethyl Corporation
451 Florida Street
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Attn: C. E. Colvin III

October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14141

Client I.D.: WELL #3

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005	<u>Miscellaneous:</u>	
Chloroform	<0.001	Tetrahydrofuran	0.110
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	<0.001		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		



Burmah Technical Services, Inc.
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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14142

Client I.D.: WELL #4

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005	<u>Miscellaneous</u>	
Chloroform	<0.001	Tetrahydrofuran	2.4
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	<0.001		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		



Burmah Technical Services, Inc.
Water Management Division

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Ethyl Corporation
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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14143

Client I.D.: WELL #7

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	0.001
Carbon tetrachloride	<0.001	Xylenes	0.001
Chlorobenzene	0.280		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005		
Chloroform	<0.001		
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	0.040		
1,2-Dichloroethane	0.300		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	0.007		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	0.018		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	0.020		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

VOA/5r



Burmah Technical Services, Inc.
Analytical Laboratories Division

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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-23-86

Sample Number: 14144

Client I.D.: WELL #8

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005		
Chloroform	<0.001		
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	0.016		
1,1,2-Trichloroethane	<0.001		
Trichloroethene	0.032		
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

VOA/6r



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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

Sample Received: 10-10-86

Sample Number: 14145

Client I.D.: WELL #9

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005		
Chloroform	<0.001		
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene		0.004	
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane	<0.001		
1,1,2-Trichloroethane	<0.001		
Trichloroethene		0.002	
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

VOA/7r



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Analytical Laboratories Division

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October 23, 1986

VOLATILE ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY

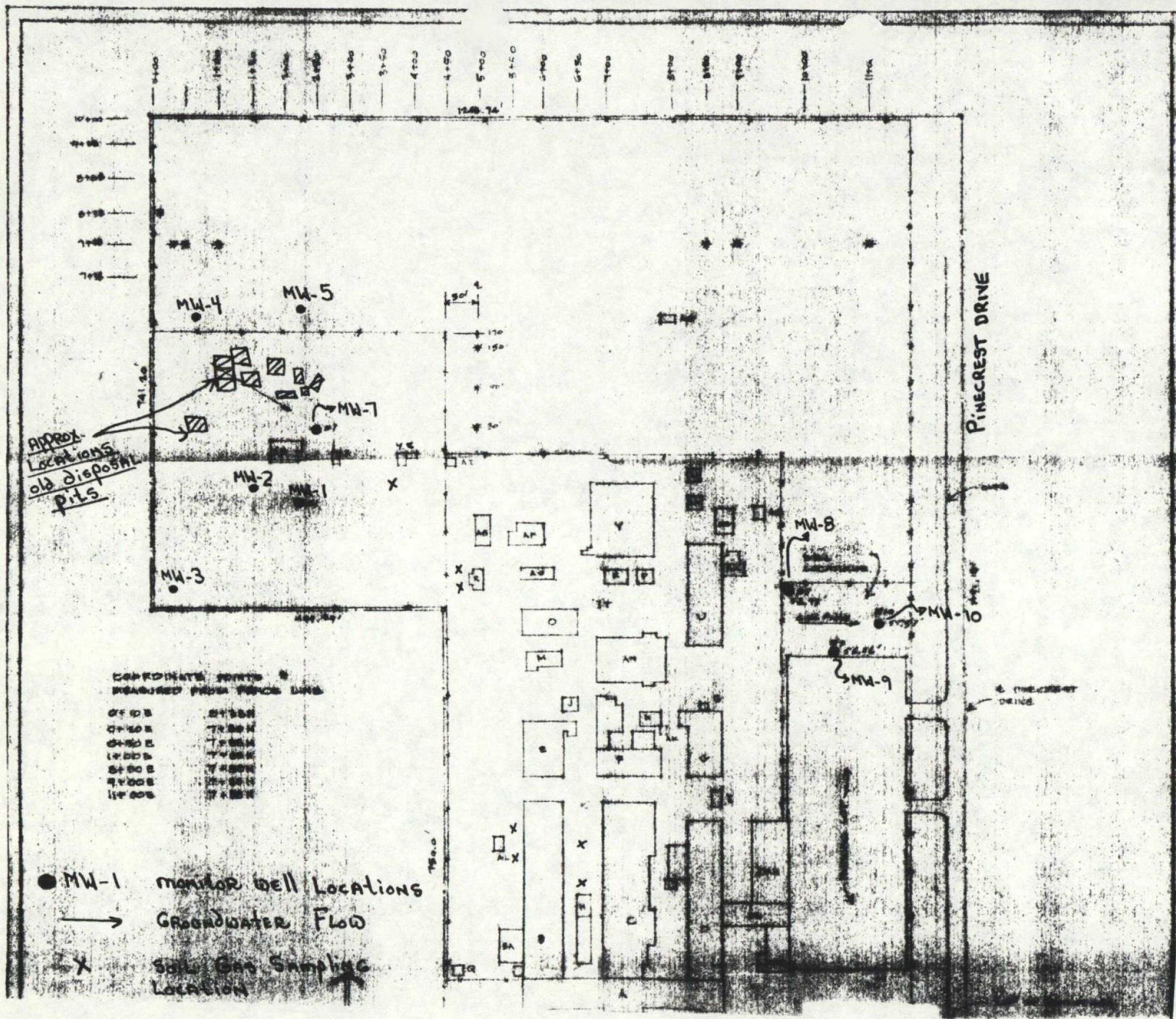
Sample Received: 10-10-86

Sample Number: 14146

Client I.D.: WELL #10

<u>Halogenated</u>	<u>mg/l</u>	<u>Aromatic</u>	<u>mg/l</u>
Bromodichloromethane	<0.002	Benzene	<0.001
Bromoform	<0.010	Ethyl Benzene	<0.001
Bromomethane	<0.005	Toluene	<0.001- 0.001
Carbon tetrachloride	<0.001	Xylenes	<0.001
Chlorobenzene	<0.001		
Chloroethane	<0.002		
2-Chloroethylvinyl ether	<0.005		
Chloroform	<0.001		
Chloromethane	<0.005		
Dibromochloromethane	<0.005		
1,2-Dichlorobenzene	<0.010		
1,3-Dichlorobenzene	<0.010		
1,4-Dichlorobenzene	<0.010		
Dichlorodifluoromethane	<0.001		
1,1-Dichloroethane	<0.001		
1,2-Dichloroethane	<0.001		
1,1-Dichloroethene	<0.001		
trans-1,2-Dichloroethene	<0.001		
1,2-Dichloropropane	<0.001		
1,3-Dichloropropene	<0.001		
trans-1,3-Dichloropropene	<0.001		
Methylene Chloride	<0.001		
1,1,2,2-Tetrachloroethane	<0.001		
Tetrachloroethene	<0.001		
1,1,1-Trichloroethane		0.044	
1,1,2-Trichloroethane	<0.001		
Trichloroethene		0.017	
Trichlorofluoromethane	<0.001		
Vinyl Chloride	<0.005		

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Baton Rouge, LA 70801
C.E. Colvin III

October 23, 1986

Sample Received: 10-10-86

<u>Sample Numbers:</u>	<u>Client I.D.</u>	<u>Lead, Pb, mg/l</u>
14139	WALL #1	<0.05
14140	#2	<0.05
14141	#3	<0.05
14142	#4	<0.05
14143	#7	<0.05
14144	#8	<0.05
14145	#9	<0.05
14146	#10	<0.05

Susan K. Scott
LABORATORY SUPERVISOR